

J-356

Scope – This standard covers normalized electric resistance welded flash controlled single wall low carbon steel pressure tubing intended for use as pressure lines and in other applications requiring tubing of a quality suitable for bending, double flaring, beading, and brazing.

Manufacture – The tubing shall be made from a single strip of steel shaped into a tubular form, the edges of which are joined and sealed by electric resistance welding. After forming and welding, the outside flash shall be removed to provide a smooth surface. The inside flash shall be of uniform contour, free from saw tooth peaks, and controlled in height by seam welding techniques or by cutting, but not by hammering or rolling. The inside flash height shall conform to the following:

Nominal Wall Thickness		Nominal Tubing Outside Diameter			
		Thru 1.000 (25.4 mm)		Over 1.000 (25.4 mm)	
		Maximum Flash Height ^A			
in	mm	in	mm	in	mm
Thru 0.035	0.90	0.005	0.13	0.010	0.25
Over 0.035 thru 0.065	0.90 thru 1.65	0.008	0.20	0.010	0.25
Over 0.065	1.65	0.010	0.25	0.010	0.25

^A For tubes having an ID greater than 0.312 in (8 mm), the height of the inside weld flash shall be measured with a ball micrometer having an 0.155 ± 0.016 in (3.96 ± 0.41 mm) radius on the anvil or ball point. For tubes having an ID 0.312 in. (8 mm) or less, screw thread micrometers shall be used. The height of the flash shall be the difference between the thickness of the tubing wall at the point of maximum height of the flash and the average of the wall thickness measured at points adjacent to both sides of the flash.

J-356

The tubing shall be normalized to produce a finished product which will meet all requirements of this standard.

Dimensions and Tolerances – The tolerances applicable to tubing outside diameter are shown in Table 1. The tolerances applicable to tubing wall thickness are shown in Table 2. Particular attention shall be given to areas adjacent to the weld to insure against thin spots and/or sharp indentations.

Quality – Lengths of finished tubing shall be reasonably straight and have smooth ends free from burrs. Finished tubing shall be free from scale and injurious imperfections shall have a workmanlike finish. Outside surface imperfections such as handling marks, straightening marks, light die marks or shallow pits shall not be considered injurious, provided the imperfections are detrimental to the function of the tubing. The removal of such surface imperfections shall not be required.

The inside surface shall be free of weld splatter, pits, and all other injurious imperfections detrimental to the function of the tubing.

Material – Tubing shall be made from low carbon hot or cold rolled steel conforming to the chemical composition shown in Table 3. If rimmed steel is used, it shall be single strand. The steel shall be made by the open hearth, basic oxygen, or electric furnace process. A ladle analysis of each heat shall be made to determine the percentages of the elements specified. The chemical composition thus determined shall be reported to the purchaser, or his representative, if requested, and shall conform to the requirements specified. If a check analysis is required, the tolerances shall be as specified in Table 3.

TABLE 1 – TUBING OUTSIDE DIAMETER TOLERANCE

Nominal Tubing OD ^{A, B}		Tolerance +	
in	mm	in	mm
Thru 0.375	9.50	0.0025	0.06
Over 0.375	9.50-15.88	0.03	0.08
Over 0.625-1.125	15.88-28.57	0.0035	0.09
Over 1.125	28.57-50.80	0.005	0.13
Over 2.000-2.500	50.80-63.50	0.006	0.15
Over 2.500-3.000	63.50-76.20	0.008	0.20
Over 3.000-3.500	76.20-88.90	0.009	0.23
Over 3.500-4.000	88.90-101.60	0.10	0.25

^A OD measurements shall be taken at least 2.0 in (50 mm) from the end of the tubing.

^B Refer to SAE J514 for nominal tubing OD to be used in conjunction with standard hydraulic tube fittings and SAE J533 for recommended max nominal wall thickness for double flaring.

Yield Strength, min	25,000 psi (170 MPa)
Ultimate Strength, min	45,000 psi (310 MPa)
Elongation in 2 in (50 mm), min	35% ^A
Hardness (Rockwell B), max	65B

^A For tubing having nominal outside diameter of 0.375 in (9.5 mm) or less, and/or wall thicknesses of 0.035 in (0.9 mm) or less, a minimum elongation of 25% is permissible.

^B The hardness test shall not be required on tubing with a nominal wall thickness of less than 0.065 in (1.65 mm). Such tubing shall meet all other mechanical properties and performance requirements.

J-356

TABLE 2 – TUBING WALL THICKNESS TOLERANCES, IN

Nominal Wall Thickness ^A	Nominal Tubing Outside Diameter					
	Thru 1.000		Over 1.000 thru 2.000		Over 2.000 thru 4.000	
	Tolerance ^C					
	Plus ^B	Minus	Plus ^B	Minus	Plus ^B	Minus
0.028	0.002	0.003	0.003	0.003	0.004	0.003
0.035	0.002	0.004	0.003	0.004	0.004	0.004
0.049	0.002	0.005	0.003	0.005	0.004	0.005
0.065	0.004	0.006	0.005	0.008	0.006	0.008
0.083	0.004	0.006	0.006	0.008	0.007	0.008
0.095	0.004	0.006	0.006	0.010	0.007	0.010
0.109	0.004	0.006	0.008	0.010	0.009	0.010
0.120	0.004	0.008	0.008	0.010	0.009	0.010
0.134	0.004	0.008	0.008	0.010	0.009	0.010
0.148	–	–	0.008	0.011	0.009	0.011
0.165	–	–	0.008	0.011	0.009	0.011
0.180	–	–	0.008	0.011	0.009	0.011
0.203	–	–	0.008	0.012	0.009	0.012
0.220	–	–	0.008	0.012	0.009	0.012
0.238	–	–	0.013	0.018	0.014	0.018
0.259	–	–	0.013	0.020	0.014	0.020

^A for intermediate wall thicknesses, the tolerance for the next heavier wall thickness shall apply

^B Plus tolerances include allowance for crown on flat rolled steel

^C Millimeter conversions of the inch tolerances are:

in	mm	in	mm	in	mm
0.002	0.05	0.007	0.18	0.012	0.30
0.003	0.08	0.008	0.20	0.013	0.33
0.004	0.10	0.009	0.23	0.014	0.36
0.005	0.13	0.010	0.25	0.018	0.46
0.006	0.15	0.011	0.28	0.020	0.51

TABLE 3 – CHEMICAL REQUIREMENTS

Element	Cast or Heat Analysis, Wgt
Carbon	0.18 max
Manganese	0.30 thru 0.60
Phosphorus	0.04 max
Sulfur	0.05 max